

### **REMARKS**

The application has been reviewed in light of the Office Action mailed on June 1, 2007. Reconsideration of the application is requested for the following reasons.

The application is subject to a restriction requirement, as discussed on pages 2-5 of the Office Action. As the Office Action correctly noted, during a telephone interview conducted on April 18, 2007, Applicants elected the claims of Group I (claims 68, 69, 76-94 and 103) for continued prosecution, without traverse. Applicants provide no further comments with respect to the discussion on pages 2-5 of the Office Action regarding the restriction requirement.

The disclosure is objected to because the reference to an earlier filed application under 37 CFR 1.78(a)(2) should include the now-available patent number. The disclosure has been amended as requested by the Office Action.

Claims 68, 69, 76-79 and 86 stand rejected under 35 U.S.C. 103 as being unpatentable over Glukhovsky et al., U.S. Patent No. 6,607,301 ("Glukhovsky") in view of Sakaue, U.S. Patent No. 4,162,411 ("Sakaue"). Reconsideration is respectfully requested for the following reasons.

Claim 68 relates to a method of determining temperature of an imager chip. Claim 68 recites "storing a fabrication process dependent value for an imager chip; [and] storing at least one chip dependent value representing a measured pixel dark current reference value and a reference temperature at which said chip dependent dark current reference value was measured." Claim 68 also recites "measuring a dark current value of a pixel on said chip; and determining a chip temperature representation based on said measured dark current value and stored values."

These are important features of the claimed invention. "The inventors have observed that a CMOS imager pixel dark current doubles every  $N^{\circ}\text{C}$  with  $N$  being a value which is process dependent and which in general ranges from 6 to 10." Specification, paragraph [0020]. The specification discloses, for example, that "one way to determine [process constant]  $\alpha$  is to use the slope of a logarithmic equation describing dark current measurements at specific sensor

temperatures for chips produced by the same process,” and that “sensor temperature can be calculated from the stored values  $\alpha$  ... and a pixel dark current measurement.” Specification, paragraphs [0025] through [0028]. The invention is not limited to the disclosed embodiments.

The Office Action admits (pp. 5-6) that Glukhovsky fails to teach or suggest the following multiple limitations of claim 68: “storing a fabrication process dependent value for an imager chip [and] storing at least one chip dependent values representing a measured pixel dark current reference value and a reference temperature at which said chip dependent dark current reference value was measured.”

Notwithstanding, the Office Action initially asserts (p. 6) that it “would have been obvious to do so since Glukhovsky et al. suggested performing calibration (column 3 lines 51-57).” This bare, unsupported assertion is traversed as failing to comply with the requirements set forth in MPEP § 2142 for establishing a prima facie case of obviousness. As the Office Action pointed out, Glukhovsky fails to teach or suggest many limitations of claim 68. The portion of Glukhovsky relied upon by the Office Action for “performing calibration” discloses a “processor capable of ... calculating the image sensor temperature 17 using the known equations derived for thermal noise. It will be appreciated that these equations are an approximation of a complex phenomenon and that calibration should be employed in order to deduce the actual calculations that will be applied.” The foregoing disclosure fails to teach or suggest the above-quoted limitations of claim 68, and the Office Action fails to explain otherwise.

The Office Action then asserts (p. 6) that the Sakaue reference discloses that “the amount of dark current changes due to temperature (thermal expansion) and depends on semiconductor substrate and manufacturing process of the device (column 1 lines 22-27).” The Office Action then asserts (p. 6) that it would have been obvious to modify Glukhovsky

by storing in the imager chip a fabrication process dependent value for an imager chip storing at least one chip dependent value representing a measured pixel dark current reference value and a reference temperature at which said chip dependent dark current reference value

was measured for performing calibration and accurately measuring image sensor temperature since Glukhovky et al. disclosed performing calibration and Sakaue disclosed that the amount of dark current in image chip (CCD device) changes due to temperature (thermal excitation) and depends on semiconductor substrate and manufacturing process of the device.

Applicants disagree with the Office Action's assertion for several reasons. Initially, Sakaue fails to teach or suggest "storing a fabrication process dependent value for an imager chip." The portion of Sakaue relied upon by the Office Action discloses that the "amount of dark current charge depends on defects of a semiconductor substrate and the manufacturing process of the device." The foregoing disclosure teaches only that dark current may depend on the manufacturing process. This fails to teach or suggest determining a "process dependent value," storing a "process dependent value," or "determining a chip temperature representation based on said ... stored values." And, the Office Action fails to explain how a disclosure that the dark current may depend on manufacturing teaches the limitations of claim 68. Thus, the references, whether taken alone or in combination, fail to teach or suggest all of the limitations of claim 68, and claim 68 is allowable based on at least this reason.

Moreover, even if Sakaue did disclose the limitations of claim 68 (and it clearly does not, as explained above), there would be no suggestion or motivation to combine the references as suggested by the Office Action. The Office Action reasons that since Glukhovsky discloses "calibration" and Sakaue discloses that dark current "depends" on manufacturing, it would have been obvious to combine such teachings. To the contrary, the teachings of the references cited by the Office Action are not related and would not suggest or motivate a combination. The "calibration" contemplated by Glukhovsky relates to "known equations derived for thermal noise," which are only "approximation(s)" and, thus, calibration should be employed. Column 3, lines 50-57. Sakaue's teaching that the "amount of dark current charge depends on ... manufacturing" has no relation to Glukhovsky's suggestion that calibration should be performed because "known equations for thermal noise ... [are] approximations." Thus, there would have been no reason –

absent the claims of the subject invention – to contemplate a combination suggested by the Office Action. For this additional reason claim 68 is allowable.

Claim 69 depends from claim 68 and contains every limitation of claim 68. Claim 69 is allowable for the same reasons claim 68 is allowable, and also because the unique combinations recited by the dependent claim are neither taught nor suggested by the cited references, whether taken alone or in combination.

Claim 76 recites “determining a temperature value using said acquired dark current signal together with a fabrication process value, and at least one other value representing a reference dark current signal of a pixel of said pixel array taken at a reference temperature.” For the reasons discussed above with respect to claim 68, claim 76 is allowable over the cited references. Claims 77-79 depend from claim 76 and are allowable for the same reasons claim 76 is allowable, and for other reasons.

Claim 86 recites “acquiring at least one dark current signal at a plurality of locations of a pixel array; and determining an associated temperature value for each of said locations using a respective said at least one dark current signal.” Glukhovsky fails to teach or suggest all of these limitations. Glukhovsky discloses that “it is possible to calculate the image sensor’s 20 temperature based on dark current data obtained from a single pixel ... though data obtained from a higher number of pixels will achieve more accurate results.” Column 4, lines 37-41. However, Glukhovsky teaches only that the values may be integrated to calculate the temperature of the sensor (column 4, lines 50-55), and fails to teach or suggest “determining an associated temperature value for each of said locations using a respective said at least one dark current signal.” Sakaue fails to add anything to Glukhovsky with respect to claim 86, and the Office Action does not contend to the contrary. Thus, claim 86 is allowable. Accordingly, the rejection should be withdrawn and the claim allowed.

Claims 80-85 and 87-92 stand rejected under 35 U.S.C. 103 as being unpatentable over Glukhovsky and Sakaue in view of Kono, JP-402022873A ("Kono"). Reconsideration is respectfully requested.

Claims 80-85 depend from claim 76 and contain every limitation of claim 76. Claim 76 is allowable over Glukhovsky and Sakaue, as discussed above. Kono adds nothing to remedy the deficiencies of Glukhovsky and Sakaue with respect to claim 76, and the Office Action does not contend to the contrary. Claims 80-85 are allowable for at least the same reasons their base claim is allowable, and also because the dependent claims recite unique combinations that are neither taught nor suggested by the cited references. Moreover, Applicants disagree that the references are properly combinable as asserted in the Office Action.

Claims 87-92 depend from claim 86 and contain every limitation of claim 86. As discussed above, claim 86 is allowable over Glukhovsky and Sakaue. Kono adds nothing to remedy the deficiencies of Glukhovsky and Sakaue with respect to claim 86, and, thus, claims 87-92 are allowable for at least the same reason claim 86 is allowable, and for other reasons.

Claims 93, 94 and 103 stand rejected under 35 U.S.C. 103 as being unpatentable over Glukhovsky and Sakaue in view of Wand, U.S. Patent No. 6,267,501 ("Wand"). Reconsideration is respectfully requested.

Claim 93 recites "calculating a chip temperature using the calibrated dark pixel signal and a fabrication process dependent value related to dark current and temperature, and a chip dependent value related to dark current and temperature." Claim 94 depends from claim 93. Claim 103 recites "calculating a separate chip temperature for each said dark pixel cluster using a said calibrated dark pixel signal for each said cluster and a fabrication process dependent value related to dark current and temperature, and a chip dependent value."

Glukhovsky and Sakaue fail to teach or suggest the forgoing limitations of independent claims 93 and 103, as discussed above with respect to claim 68. Wand fails to remedy the

deficiencies of Glukhovsky and Sakaue with respect to claim 68, and the Office Action does not contend to the contrary. Claims 93, 94 and 103 are allowable based on at least the reasons discussed above with respect to claim 68, and for other reasons. Accordingly, the rejection should be withdrawn and the claims allowed.

In view of the above, Applicants believe the pending application is in condition for allowance.

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